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" Development of Polymeric Lanthanum Nanocomposite for Phosphorus Removal and Recovery：Fundamentals and Application "

by

Dr. Yanyang ZHANG
Assistant Researcher, School of the Environment, Nanjing University, Nanjing, China

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Abstract

In recent years, polymer supported nano-sized metal oxides (Fe or Zr based) has attracted great attention for their sound performance in advanced phosphorus removal and recovery. In our study, a new nanocomposite adsorbent La-201 of extremely high capacity and specific affinity towards phosphate was developed, where hydrated La(III) oxides (HLO) nanoclusters were immobilized inside the networking pores of the polystyrene anion exchanger D-201. Column adsorption runs by using La-201 could effectively treat ~6500 bed volumes (BV) of a synthetic feeding solution before breakthrough occurred (from 2.5 mg P/L in influent to <0.5 mg P/L in effluent), approximately 11 times magnitude higher than HFO-201. The exhausted La-201 could be regenerated for repeated use without any significant capacity loss. Based on STEM-EDS, XPS, XRD, and SSNMR analysis, and the formation of LaPO4·xH2O during P uptake by La is verified to be the dominant pathway, this transformation is reversible after regeneration. However, it was difficult for bulk La(OH)3/HLO nanoparticles to transform to LaPO4·xH2O during P adsorption, only a small portion of LaPO4·xH2O was observed after 25 days reaction. It was expected that the crystal transformation of HLO to LaPO4·xH2O is both time and space dependent. Our nanocomposites La-201 was employed for scaled-up and pilot stage test, it could reduce TP (0.025-0.075 mg/L) from phosphorus contaminated water samples to <0.01 mg/L. We believe that La-201 is a promising tool to solve phosphorus problem from various water sources.

Biography

Dr. Zhang obtained his PhD degree from Nanjing University (Environmental Engineering) in 2016. His research interest includes Phosphorus removal and recovery from waste streams; Empirical modeling and mechanistic modeling for water treatment system; and Novel adsorbents for water and wastewater treatment. He has authored papers published NanoImpact, Environmental Science and Technology, Chemosphere, Chemical Engineering Journal, Journal of Hazardous Materials, Water Research, and ACS Applied Material & Interface.

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